

CLAIMS

What is claimed is:

1. In a process for high temperature oxidation of a gaseous reactant in a shell and tube reactor of the class with a plurality of reactor tubes wherein the reactor tubes are immersed in a heat exchange medium contained within the shell and the interior volume of the reactor tubes is thereby isolated from the heat exchange medium and wherein reactor tube interior inlets are in communication with a feed plenum having a characteristic cross-sectional area in the vicinity of the reactor tube inlets generally free from obstruction, such that the velocity of a feed gas mixture to the reactor tube inlets is the volume rate of flow of the feed gas mixture divided by the characteristic cross-sectional area of the plenum in the vicinity of the reactor tubes, the process being generally of the class wherein the feed gas mixture is fed from the plenum to the reactor tubes, the improvement comprises:

disposing a short bed of packing material adjacent to the reactor tube inlets, and wherein the short bed occupies less than about 20 percent of the volume of the feed plenum and

wherein the short bed has a voidage of from about 0.3 to about 0.75 and is thereby operative to increase the velocity of the feed gas mixture in the vicinity of the reactor tube inlets whereby contamination of the feed plenum by the heat exchange medium is controlled in the event of a reactor breach in the vicinity of the reactor tube inlets.

2. The method according to Claim 1, wherein the packing material comprises macroparticles.

3. The method according to Claim 1, wherein each macroparticle is from about 0.125 inches in diameter to about 4 inches in diameter.

4. The method according to Claim 3, wherein each macroparticle is less than about 2 inches in diameter.

5. The method according to Claim 1, wherein the macroparticles comprise ceramic macroparticles.

6. The method according to Claim 2, wherein the macroparticles are substantially spherical in shape and have an average diameter of from about 0.125 to about 4 inches.

7. The method according to Claim 2, wherein the macroparticles are selected from a group consisting of spheres, pellets disks, hollow tubes, rods and plates.

8. The method according to Claim 7, wherein the macroparticles are spheres.

9. The method according to Claim 8, wherein the spheres are DENSTONE balls.

10. The method according to Claim 9, wherein the DENSTONE balls are selected from the group consisting of DENSTONE 57, DENSTONE 2000 and DENSTONE 99.

11. The method according to Claim 1, wherein the oxidation reaction comprises oxidation of isobutylene to methacrylic acid.

12. The method according to Claim 1, wherein the oxidation reaction comprises oxidation of butane to maleic anhydride.

13. The method according to Claim 1, wherein the oxidation reaction comprises oxidation of propylene.

14. The method according to Claim 1, wherein the heat exchange medium is a molten salt coolant.

15. The method according to Claim 14, wherein the salt is a HITEC salt.

16. The method according to Claim 15, wherein the salt about 53% potassium nitrate, about 40% sodium nitrate, and about 7% sodium nitrate.

17. The method according to Claim 1, wherein the short bed occupies less than about 10 percent of the volume of the feed plenum.

18. In an apparatus for high temperature oxidation of a gaseous reactant in a shell and tube reactor configured for flowing a feed gas mixture to the tubular reactor through a distributor, and directing the feed gas mixture from a feed plenum to a plurality of reactor tubes through their inlets communicating with the feed plenum, the reaction tubes being immersed in a heat-exchange medium at a temperature of from about 200°C to about 400°C, the improvement which comprises:

a short bed of packing material adjacent to the reactor tube inlets wherein the short bed has a voidage of from about 0.3 to about 0.75, whereby contamination of the feed plenum by any decomposition gases of the heat exchange medium is controlled in the event of a reactor breach in the vicinity of reactor tube inlets, and wherein the short bed occupies less than about 20 percent of the volume of the feed plenum.

19. The apparatus according to Claim 18, wherein diameter of each reaction tube is from about 0.75 inches to about 2 inches.

20. The apparatus according to Claim 18, wherein depth of the short bed of packing material is from about 10 inches to about 25 inches.

21. The apparatus according to Claim 20, wherein depth of short bed is at least 10 inches.

22. In a method for manufacturing acrylic acid in a shell and tube reactor for oxidizing propylene comprising flowing a feed gas mixture to a feed plenum through a distributor, and directing the feed gas mixture from the feed plenum to a plurality of reactor tubes disposed in the shell and tube reactor, the reactor tubes being immersed in a molten salt coolant at a temperature of from about 200°C to about 400°C, the improvement which comprises:

providing a short bed of packing material adjacent to reactor tube inlets of the reactor tubes wherein the short bed occupies less than about 20 percent of the volume of the feed plenum; and

contacting the feed gas mixture with the short bed.